Chapter 8

Conclusion

BRIEF SUMMARY OF THE MAIN RESULTS

The recent interest in clinical neuropsychology to extrapolate from the test scores of brain damaged patients to their performance in everyday life, has resulted in an appeal for more ecologically valid test methods (Hart & Hayden, 1986; Sunderland et al., 1983). The study reported in this thesis tried to meet this appeal by investigating the memory impairments in head injured patients for stimuli whose ecological validity is undisputed, namely people's names. Learning new names or retrieving the names of familiar people are important tasks in one's everyday social life. In addition to its ecological validity, an investigation of memory for people's names in head injured patients was important because of the high frequency of subjective reports about problems in remembering people's names in these patients. Although the complaints concerning memory for people's names have been reported by various studies, examination of memory for people's names in head injured patients with objective measurements has received very little attention.

This study might be one of the first to examine several aspects of memory for people's names following closed head injury using objective rather than subjective assessment methods. The study was directed at three main questions. First, can the subjective reports of closed head injured patients about impaired memory for people's names be substantiated by objective measurements? Second, how selective is their impairment in memory for people's names and which factors may contribute to the impairment? Third, is it possible to rehabilitate memory for people's names in head injured patients? Detailed discussions of the relevant findings have already been presented in the preceding chapters. Therefore, a very brief summary of the most important results relevant to the three main questions will suffice here.

First, memory for people's names proved clearly impaired in the head injured patients seen for this study, who had all suffered a severe closed head injury. Learning new names as well as retrieving the names of familiar persons was significantly worse in the patient groups than in the normal control groups. Inspection of the individual data from 22 patients showed that only one patient performed within the normal range in all of the most important tasks. So, the results for objective measurements clearly supported the subjective reports.

Second, the patients' impairment in learning names to unfamiliar faces could not be attributed to impaired recognition of the unfamiliar faces. Furthermore, the effect of meaningfulness of the name on name learning was equivalent in the head injured patients and the normal controls. There were no indications that the patients were more severely impaired in learning either meaningful or meaningless names. The problems with learning people's names appeared to be related to problems with learning other verbal information,

because the patients' name learning impairment was proportional to their impairment in learning other information to faces. Therefore, the name learning impairment in head injured patients is probably a manifestation of the verbal learning impairment, which is a well-known consequence of closed head injury, rather than a selective impairment.

The patients' impaired retrieval of the names of familiar people appeared to result from problems activating the phonological name information. Recognition of familiar persons, as assessed by familiarity decisions, and access to the identity specific semantic information, were relatively intact in the patients, although the response latencies in most of these tasks were significantly longer in the patients than the controls. Therefore, the problems with person naming retrieval were interpreted as an expression of a more general disturbance in the information processing of head injured patients. This suggestion was supported by the finding that retrieval of another category of proper names, the names of famous buildings, proved equally problematic for the patients as personal name retrieval.

Third, rehabilitation of memory for people's names was successful with regard to name learning. Teaching head injured patients to attach more meaning to people's names, instead of the traditional face-name associations, clearly improved their name learning performance. This improvement could not be attributed to the effect of repeated testing or to the intensive attention received by the patients during the training. However, retrieval of familiar person's names was hardly affected by the training. Apart from limitations of the test used to evaluate name retrieval, the strategies taught to improve name retrieval might have been inappropriate for ameliorating the disrupted access to the name information.

The results of the experiments and the memory training are not only relevant to the three main questions of this study. The results may have additional implications for the understanding of memory for people's names and the cognitive impairments of closed head injured patients. Some of these points are discussed in the next two sections.

IMPLICATIONS FOR MEMORY FOR PEOPLE'S NAMES IN NORMAL SUBJECTS

First of all, results reported in Chapters 6 and 7 suggested that memory for people's names is not a single concept, but that learning new names and retrieving the names of familiar people are distinct processes. The performance patterns of individual head injured patients showed a double dissociation between name retrieval and name learning impairments. Furthermore, the patients' name learning performance did improve with training, while name retrieval did not. Rather than one memory for people's names there appear to be two separate memory processes, one concerned with storing the names of newly met people, and the other concerned with retrieving the names of familiar persons from an established memory store. Bruce et al.'s (1994) criticism of studies which try to generalize results from name learning tasks to name retrieval seems justified.

Nevertheless, Brédart and Valentine (in press) showed that findings from name

learning studies can sometimes be relevant to the understanding of name retrieval. Brédart and Valentine showed that the degree of meaningfulness of a name, which is known to affect name learning, had a similar effect on name retrieval. Cartoon characters with meaningful names, that is, names which referred to characteristics of the character (e.g. Gaston Lagaffe) were better named than cartoon characters with relatively meaningless names (e.g. Tintin). However, an experiment such as Brédart and Valentine's (in press), conducted with names of cartoon characters is probably impossible to conduct with people's names. The names of cartoon characters are often descriptive simply because they are carefully chosen by the creators of the characters, while the name of a familiar person seldom refers to features typical of that person. Still, Brédart and Valentine's study supported the notion that people's names may be difficult to retrieve because they are pure referring expressions. People's names, like the meaningless cartoon character names, convey very little information about the individual they designate.

Although the study reported in this thesis was not meant to test different models for person naming, several findings are relevant to this issue. The IAC models proposed by Brédart et al. (1995) and Burton and Bruce (1992) could provide a parsimonious explanation for the naming impairments and the relatively long latencies in person recognition tasks of the head injured patients. However, Burton and Bruce's model has become less credible as a valid model for person naming, since Brédart et al. (1995) posed strong arguments against this model. Burke et al.'s (1991) node structure model, which has distinct similarities with the model of Brédart et al. (1995), could also account for the patients' performance in the naming tasks. Recently, Valentine et al. (1996) combined these two models into a new one by replacing the "lexical output units" box of Brédart et al.'s model with the structures of the name lexicon proposed by Burke et al. (1991). This new model distinguishes between personal name lemmas, which represent syntactic information about the name, and personal names lexemes, which represent the phonological name information. The conclusion of Chapter 4 that the naming impairments in the head injured patients appeared to arise at the level of activating the phonological name information, in the name lexeme, illustrates the importance of a distinction between syntactic and phonological name representations.

An interesting finding was the close parallel between person naming and building naming in both the head injured patients and the normal controls. This result suggests that people's names are not fundamentally different from object names. Retrieval of object names which designated an individual item, as was the case with the famous buildings, rather than a category of items is very similar to retrieval of people's names. Previous studies in normal subjects (Johnston & Bruce, 1994) and brain damaged patients (Harris & Kay, 1995a,b; Semenza & Zettin, 1988; 1989) have also suggested parallels between personal name retrieval and retrieval of other categories of proper names. The similarities between person and building naming implies that models of person naming should be able to account for the production of unique object names. In general, proper names have a unique

referent and several models of person naming have incorporated this characteristic by proposing a single link between a token marker, representing the referent, and the name information (Burton & Bruce, 1992; Brédart et al. 1995; Burke et al., 1991). As the names of unique objects also have a unique referent, the architecture of these models could account for the naming of unique objects as well as of familiar persons. Brédart (1993) proposed the hypothesis that people's names are more difficult to recall than generic object names, because these objects can be described by different labels, unlike familiar people who usually have a single, unique name. Brédart's hypothesis could account for the similarity between personal names and the names of unique objects, because naming unique objects has the same restriction as naming familiar person: retrieval of a single specific label.

Impairments in producing personal names do not always co-occur with impairments in producing the names of unique objects. Several of the patients with personal name anomia had relatively little problems with naming unique objects, such as famous monuments, mountains or rivers (Fery et al., 1995; Lucchelli & de Renzi, 1992; Verstichel et al., 1996). These dissociations between categories of proper names could mean that the name lexicon is organised into categories with separate representations for the names of people, buildings, mountains, etc. However, Valentine et al. (1996) suggested an alternative explanation based on the plausible phonology hypothesis by Brennen (1993), which was already discussed in Chapter 1. According to Brennen (1993), names from categories which have a high new exemplars rate would be more difficult to retrieve than names from categories with a relatively low new exemplars rate. So, people's names could be more difficult to retrieve than other categories of proper names because we are confronted much more frequently with new exemplars of people's names than with new exemplars from other categories of proper names. Brennen's hypothesis requires no categorically organised name lexicon to account for the dissociation between impaired person naming and spared naming of unique objects.

However, results reported in Chapter 5 and 6, are not in line with Brennen's (1993) hypothesis. First, it is probably safe to assume that one is confronted considerably less frequently with new names of famous buildings than with new personal names. Consequently, Brennen's (1993) hypothesis would predict that, all other things being equal, naming famous buildings should be easier than naming famous persons. Experiments 5.1 and 5.2 did not confirm this prediction, since the latencies for naming famous buildings and persons and the number of name blocks with both types of item were very similar. In Experiment 5.2 the latencies for building naming were even significantly longer than the latencies for person naming, despite the fact that care had been taken to match the famous buildings and persons on familiarity. Second, inspection of the data of individual patients in Chapter 6 revealed two patients whose naming of familiar people was normal, while their naming of famous buildings was impaired. This is exactly the response pattern that would falsify the plausible phonology hypothesis (Valentine et al., 1996), because the plausible

phonology hypothesis predicts that the category of proper names with the highest new exemplar rate, i.e. people's names, is the category which should be most difficult to retrieve and be most vulnerable to brain injury. Although it can not be ruled out completely that the building naming impairment in these two patients was due to chance, low familiarity of the buildings or normal variation, the findings with building naming may cast doubt on Brennen's hypothesis. This does not necessarily mean that the name lexicon is organised into distinct categories after all. Valentine et al. (1996) mentioned at least two other variables which might account for dissociations in the retrieval of different categories of proper names: the total number of exemplars known from each category and the age of acquisition of the names from a particular category. However, to date, the effects of these variables on naming performance have hardly been explored.

IMPLICATIONS FOR MEMORY FOR PEOPLE'S NAMES IN CLOSED HEAD INJURED PATIENTS

As mentioned earlier, the difficulties with learning people's names in the head injured patients appeared to be related to verbal learning problems. On the whole, the name learning impairment in the patients was proportional to their impairment in learning other verbal information to faces. The only exception was found with meaningful names and possessions in Experiment 3.4, where the advantage for possession recall over name recall was significantly larger in the patients than in the controls. Inspection of the individual data from 22 of the head injured patients also suggested that learning people's names and learning other verbal information are associated tasks. Given these similarities between verbal learning and name learning performance in the patients, it is plausible that the same deficit thought to underlie the verbal learning impairment in head injured patients also underlies the name learning impairment. There are various explanations for the verbal learning impairment following closed head injury, which were briefly discussed in Chapter 2. One of the most important explanations proposes a deficit in the ability to apply effortful operations that are needed to encode and store verbal information in a form which allows explicit report of that information on demand (Levin, 1989).

The fact that the patients' ability to learn people's name was poorer than their ability to learn other verbal information, is more likely to reflect the greater difficulty with people's names rather than a selective impairment in name learning. In general, the difference between name recall and recall of other verbal information was equivalent in the head injured patients and the normal controls. Therefore, it is plausible that the relative difficulty in learning people's names is due to the same causes in head injured patients as in normal subjects. The main explanations given for the difficulty in learning people's names are their lack of meaning and the tendency of subjects to use relatively few strategies when learning people's names (Cohen, 1990; McWeeny et al., 1987). The results of Experiment 3.4 gave

support to both explanations. Patients and controls recalled significantly fewer meaningless names than meaningful names, and the patients recalled fewer names than possessions, even though these items were described by the same nouns. The beneficial effect of training on the patients' name learning performance also supports the lack of meaning explanation.

The impairment in naming familiar persons in the head injured patients appeared to result from problems accessing or activating the phonological name information. This same problem may be responsible for the anomic symptoms which have been reported in head injured patients (Kerr, 1995; Hartley & Levin, 1990; Thomsen, 1975). However, Kerr (1995) found that semantic errors (replacing the correct name with a semantically related name) accounted for the vast majority of the naming errors in the head injured patients she tested with the Boston Naming Test. Kerr's finding might suggest a disturbance at the semantic level rather than at the lexical level in the head injured patients. However, this result may be related to the class of names the subjects have to retrieve for the Boston Naming Test, namely common names. Name blocks, which are characterized by disrupted access to the phonological name store, are quite unlikely to occur when naming the objects of the Boston Naming Test, because there are several possible alternatives for the target names, such as synonyms or the names of the superordinate category or a subordinate category (Brédart, 1993). For example, a canoe could be named as a boat, and a tree could be named as an oak. However, most of these responses will be scored as errors in the Boston Naming Test, and the majority will be categorized as semantic errors. By contrast, there are no plausible alternatives available when naming a familiar person. Consequently, the chance for name blocks to occur with personal names is substantially larger than with common names, since there is no way to circumvent a potential failure to access the phonological lexicon. So, Kerr's (1995) results are not necessarily in conflict with the conclusion that personal name retrieval in head injured patients is impaired because of disturbed access to the phonological lexicon. In fact, Kremin (1988) suggested that circumlocutions and semantic paraphasias in naming, responses which would often be rated as semantic errors, may be evidence for intact semantic processing but impaired lexical access.

In this study, naming performance was always assessed by presenting the subjects with pictures of famous faces or buildings. None of the naming tasks employed verbal descriptions of the items to be named. The main reason for presenting pictures, instead of verbal descriptions, was that it is impractical to use verbal descriptions when measuring naming latencies. On the other hand, the exclusive use of pictures might have confounded naming impairments with visual recognition impairments. However, there are several arguments against the possibility of such a confounding. First, visual perceptual deficits are rare in head injured patients (Richardson, 1990; Van Zomeren & Saan, 1990). Second, there were no clear indications for recognition impairments in the results of Experiments 4.3, 4.4, 4.5 and 5.2. The patients' level of accuracy was normal in all the tasks which did not require articulation of the names. Third, verbal descriptions of famous persons were used during the

training, and these descriptions appeared just as effective as face pictures in inducing name blocks in the head injured patients. Therefore, it is very plausible that the use of verbal descriptions as stimuli would have yielded the same conclusions concerning name retrieval in the head injured patients as were found with the pictures.

The impairments of the head injured patients in the naming tasks agreed rather well with the results of simulations with the "impaired" IAC models of person naming (Brédart et al., 1995; Burton et al., 1991). The impairment in the IAC models was achieved by reducing the strength of the links connecting the models' processing nodes. Attenuation of the link strength between information processing nodes was previously proposed as an explanation for the reduced rate of information processing in closed head injured patients (Brouwer, 1985; Van Zomeren & Brouwer, 1994). The reduction in information processing rate is reflected in longer reaction times, and would result in a reduction in the effective information processing capacity. This reduction in capacity could also explain certain aspects of the attention and memory impairments found in head injured patients (Van Zomeren et al., 1984; Van Zomeren & Saan, 1990). Although reduced information processing rate is often regarded as the central deficit in closed head injury which underlies various cognitive impairments, there are surprisingly few explanations for the deficit. The reduced link strength hypothesis represents one of the rare attempts to explain the slowing in information processing. To date, few studies have directly tested the hypothesis in head injured patients. One exception was the study by Tromp and Mulder (1991) whose findings concerning a disproportional slowing in novel tasks in head injured patients were in line with predictions from the reduced link strength hypothesis. Further support for the hypothesis was provided, via the IAC models of person naming, by the results of the head injured patients in the person naming tasks reported in Chapter 4.

To conclude, the impairments in memory for people's names in the closed head injured patients were not selective, in the sense that the impairments appeared to be manifestations of more general cognitive impairments affecting other domains besides memory for people's names. Poor name learning seemed related to poor verbal learning and poor person naming seemed related to disturbances in the information processing system of head injured patients. There are at least three possible reasons for this result. First, the absence of clear evidence for selective impairments in memory for people's names in head injured patients may, to some extent, be a consequence of the approach to study groups rather than individual patients and to select patients for their etiology, severe closed head injury, rather than their impairments. In the group means nearly all individual differences are equalled out, thus concealing potentially interesting patterns of impairments in particular patients (Shallice, 1979). On the other hand, inspection of the individual data of 22 of the 33 participating patients revealed only a few patients with selective impairments in personal name learning or retrieval. Two patients showed a dissociation between impaired name learning and normal verbal learning. One patient had a name learning impairment in the

context of normal name retrieval and one other patient showed the reverse pattern, while a dissociation between normal person naming and impaired building naming was found in just two other patients. These findings were reassuring because they indicated that the performance patterns based on the group means provided a fairly accurate reflection of the performance of the majority of patients who participated in this study.

A second possible reason for the absence of selective impairments in memory for people's names in the patient groups is that it may reflect a genuine characteristic of closed head injured patients. Highly selective impairments, for example in personal name retrieval (Semenza & Zettin, 1989) or face recognition (De Haan, Young, Newcombe, 1987), can occur following head injury. However, the cognitive impairments of head injured patients typically reported in the literature, impairments in verbal and visual memory and in the rate of information processing, are not very specific (Richardson, 1990; Van Zomeren & Saan, 1990). Again, the traditional approach using group studies to investigate the cognitive sequelae of closed head injury may be partly responsible for the failure to find more selective impairments. However, the fact that the most common structural brain damage following closed head injury is diffuse axonal damage (Richardson, 1990), may also be relevant here. It seems plausible to assume that the diffuse brain damage, which might disrupt the effective transmission of signals within the brain, is more likely to impair general processes involved in normal memory performance and information processing, than to impair highly specific functions which may rely on a specific area in the brain. Therefore, the low incidence of selective impairments in head injured patients might be a consequence of the nature of the brain damage found most frequently in these patients.

Finally, a third reason why impairments in memory for people's names appeared secondary to more general impairments in the head injured patients, may have to do with properties of people's names. People's names are not special, as there is yet no convincing evidence that memory for people's name is subserved by a distinct process (Brédart et al., 1997). It is true that people's names are relatively difficult to learn and to retrieve, but people's names appear not fundamentally different from other types of names. This was illustrated by the close parallel between person naming and building naming reported in Chapter 5. In addition, people's names are probably not fundamentally different from other verbal information. This was suggested, for example, by Cohen's (1990) and my finding that meaningless names are recalled as poorly as meaningless possessions. Because there is no evidence for a distinct process mediating memory for people's name (Semenza et al., 1995), learning and retrieval of people's names are probably served by the same verbal memory and language functions that are involved in other learning and naming tasks. It is therefore understandable that impairments in memory for people's names usually co-occur with impairments in other learning or naming tasks.